(No Model.)

T. A. EDISON.

ELECTRICAL METER.

No. 293,435. Patented Feb. 12, 1884.

Fig. 1.

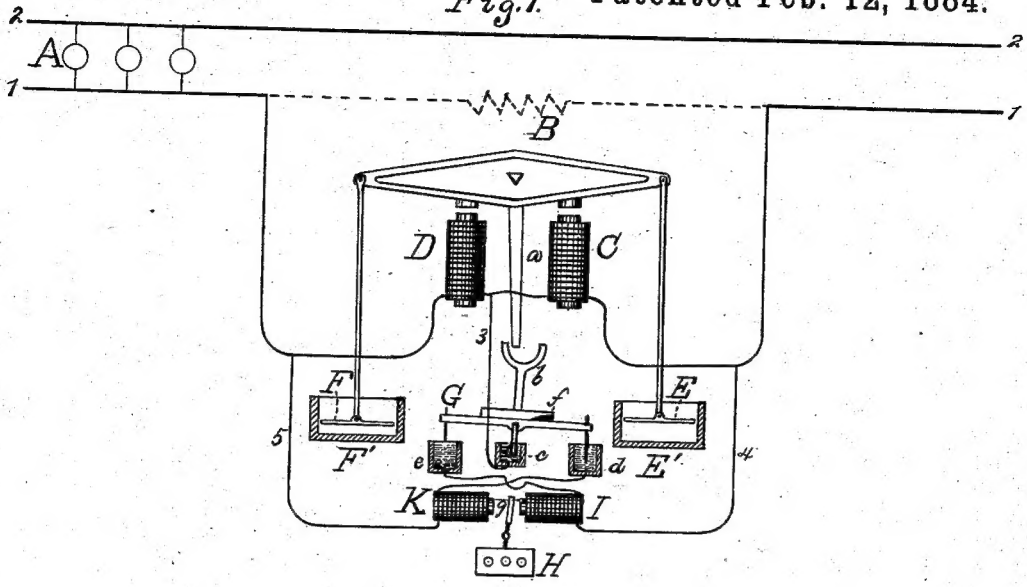
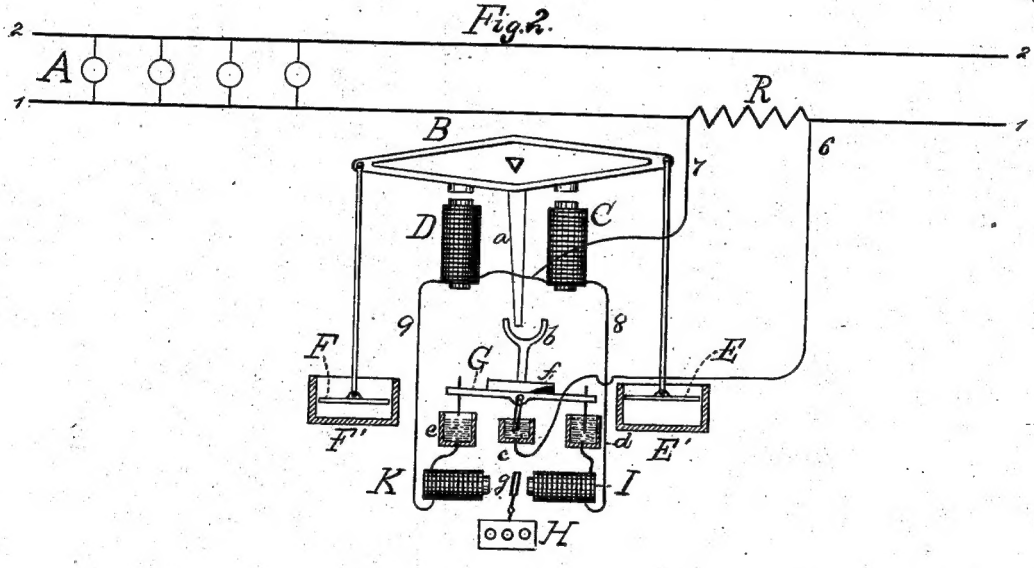


Fig. 2.



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ELECTRICAL METER.

SPECIFICATION forming part of Letters Patent No. 293,435, dated February 12, 1884.

Application filed August 14, 1882. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented a new and useful Improvement in Electrical Meters, (Case No. 457;) and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The object I have in view is to produce simple and efficient means for measuring the electrical energy consumed in a circuit, which will record automatically, and will be constructed wholly of mechanically-operating parts not liable to get out of order and not requiring renewal. This I accomplish by the use of one or more reciprocating dash-pot plungers, which retard the movement of an electro-magnetic mechanism operated by the current in the circuit, or a portion thereof, and working, by its movement, a recording apparatus. The dash-pot or dash-pots employed may be of ordinary construction; but, instead of using a liquid in the dash-pots, I prefer to use the air as a retarding force, which I am enabled to do effectively by making the plungers of large area. The electro-magnetic mechanism acts upon a pivoted beam, to which the dash-pot plungers are attached. It may be of any suitable construction; but I prefer to employ two electro-magnets, acting upon armatures secured to a pivoted or suspended beam on opposite sides of the point at which the beam is pivoted or suspended. The beam is connected at its ends to the reciprocating plungers of dash-pots, which retard the movement. These electro-magnets are located directly in the circuit or in a shunt therefrom. The beam has an arm which works a pivoted circuit-controller, making and breaking contact at mercury-cups. When the electro-magnets are located directly in the circuit, the movement produced by each electro-magnet opens a shunt around the other electro-magnet and closes a shunt around itself. The electro-magnets are thus made to predominate alternately, while the circuit is kept constantly closed. When the electro-magnets are in a shunt from the circuit the consumption of electrical energy in which is being measured, the circuit-controller makes and breaks the circuits of the electro magnets alternately or closes and opens shunts, as in the first case. The circuit-controller is a pivoted bar having a U-shaped arm projecting upwardly, and engaging with an arm from the pivoted beam. The circuit-controlling bar carries two points dipping alternately in mercury-cups, and a central point dipping permanently in the mercury of a third cup. To throw the circuit-controlling bar to the limit of its movement after it has been moved over the center by the arm from the beam, I employ a tube partly filled with mercury. This tube is carried by the bar, and the mercury in it flows to one end or the other as the bar tips over the center, throwing it to the end of its movement. A weight may be employed for this purpose, as heretofore in circuit-controllers of this character; but the mercury-tube is preferred.

The recording apparatus may be worked by a mechanical connection with the pivoted beam or the circuit-controller; but it is preferred to employ two electro-magnets for this purpose, the circuits of which are made and broken alternately by the circuit-controller. When the main electro-magnets are located directly in the circuit, these electro-magnets for working the recording apparatus will be located in the shunt-circuits which are completed alternately around the main magnets; but when the main electro-magnets are in a shunt from the circuit, the recording electro-magnets can be placed in the divisions of this shunt with the main electro-magnets. The lamps, motors, or other translating devices are preferably arranged in multiple-arc circuits. The speed of the electro-magnetic mechanism will vary with the number of translating devices in circuit, and the recording apparatus will indicate accurately in any units desired the electrical energy consumed in the circuit.

The foregoing will be better understood from the drawings, in which—

Figure 1 is a view, partly diagrammatic, of the preferred form of meter located directly in the circuit; Fig. 2, a similar view of the preferred form of meter located in a shunt from the circuit.

1 2 are the main conductors of a house or

other consumption circuit in which are placed lamps, motors, or other translating devices, A, preferably arranged in separate multiple-arc circuits, as shown.

The meter is composed of a pivoted or suspended beam, B, Figs. 1 and 2, carrying armatures on opposite sides of its pivot, acted upon by two electro-magnets, C D. At its ends the beam B is connected with reciprocating dash-pot plungers E F, which are preferably of large area and work against the retarding force of the air in cylinders E′ and F′, closed at one or both ends. The beam B has an arm, *a*, projecting downwardly from its center and engaging with the U-shaped stirrup on the end of the arm *b* of a pivoted circuit-controlling bar, G. This circuit-controller carries a central pin dipping permanently in the mercury of a cup, *c*, and two end pins dipping alternately in the mercury of cups *d e*. The bar G has a tube, *f*, partly filled with mercury, secured thereto, for throwing the circuit-controller to the limit of its movement after it is tipped over the center by the movement of the beam B.

H represents any suitable recording apparatus, which may be moved by a mechanical connection with the beam or circuit-controller; but it is preferably worked by two electro-magnets, I K, acting alternately upon an armature-lever, *g*.

With reference to Fig. 1, the electro-magnets C D are placed directly in the conductor 1 of the consumption-circuit. Between the electro-magnets C D a connection, 3, is made with the permanent contact-cup *c*. Outside of the electro-magnets C D connections 4 and 5 are made with mercury-cups *e* and *d*, respectively, after passing through the coils of the recording electro-magnets I and K. Conductors 3, 4, and 5 form shunts around the magnets C D, which are completed alternately by the circuit-controller, while the main circuit always remains closed.

When the parts are in the position shown in Fig. 1, the current flows from 1 on the right of C D, through C, 3, *c*, G, *d*, K, and 5, to 1 on the left of C D. Current will also flow through D, but, the shunt 3-5 being closed around D, its energy will be small compared with that of C. C will draw B down until G is thrown over the center, when contact will be broken at *d*, and made at *e*. K will also attract *g*, working the recording apparatus. Now the current will flow from 1 on the right of C D, by 4 I *e* G *c* 3 D, to 1 on the left of C D. The shunt 3 4 is now closed around C, and hence D will now predominate, although a small current will flow through C. The beam B will be tipped in the opposite direction, and I will attract *g*. This same arrangement of circuits could be used in a shunt around resistance, in which case the conductor 1 would be extended, through resistance, around the magnets C D, as shown in dotted lines in Fig. 1.

In Fig. 2 the magnets C D are in a shunt, 6 7, around resistance R, located in conductor 1 of the consumption-circuit. Conductor 7 is divided, and runs to both magnets C D, and from these magnets separate connections 8 9 extend to magnets I K and cups *d e*. Conductor 6 extends directly to the cup *c*. In the position shown in the drawings, the current flows from 1 on the right of R, by 6, *c*, G, *d*, I, 8, C, and 7, to 1 on the left of R. Magnets C I are energized, while the circuit of D and K is broken. The beam B will be attracted by C, and the lever *g* by I. The circuit-controller will be thrown after the beam B has made a definite movement, breaking contact at *d*, and making contact at *e*. Now the current will flow from 1 on the right of R, by 6, *c*, G, *e*, K, 9, D, and 7, to 1 on the left of R, and D K will be energized, while the circuit of C I will be broken.

It will be understood that the speed of movement of the electro-magnetic mechanism varies in direct proportion to the variation in the energy consumed in the circuit in a given time, and hence the recording apparatus will give an accurate record of the consumption that takes place.

What I claim is—

1. In an electrical meter, the combination of the pivoted beam, oscillated by an electro-magnetic mechanism for moving the beam in both directions by electro-magnetic action, of a recording apparatus, and reciprocating dash pot plungers attached to such beam, substantially as set forth.

2. In an electrical meter, the combination, with a pivoted beam, of electro-magnets for tipping such beam in opposite directions, a circuit-controller moved by the beam, and a recording apparatus, substantially as set forth.

3. In an electrical meter, the combination, with a pivoted beam, of electro-magnets for tipping such beam in opposite directions, means for retarding the movement, a circuit-controller moved by the beam, and a recording apparatus, substantially as set forth.

4. In an electrical meter, the combination, with the pivoted beam, the main electro-magnets, and the dash-pots, of the circuit-controller operated by the beam, the recording apparatus, and the electro-magnets for working such recording apparatus, substantially as set forth.

5. In an electrical meter, the circuit-controller composed of a pivoted bar, mercury-cups in which the circuit is made and broken, a mercury-cup for constantly maintaining electrical connection with the moving bar, and a tube partly filled with liquid, for throwing the bar to the limits of its movements, substantially as set forth.

This specification signed and witnessed this 7th day of July, 1882.

THOMAS A. EDISON.

Witnesses:
RICHD. N. DYER,
EDWARD H. PYATT.